RESEARCH ARTICLE

Association of Ultrasound Estimated Fetal Weight between 10th and 50th Centile in Third Trimester with the Risk of Spontaneous Preterm Delivery

[1]Muralidhar V Pai, [2]Caroline R Mathias

ABSTRACT

Objective: To find out the association of ultrasound estimated fetal weight (UEFW) between 10th and 50th centile, in early third trimester and the risk of spontaneous preterm delivery.

Materials and methods: Fetal weight of 965 women with singleton pregnancy was estimated between 28 and 34 weeks. Women with multiple gestation, medical disorders, fetal anomalies and induced labor were excluded. Values of UEFW were converted into centile values and multiples of median (MoM) for each gestational age. The risk of spontaneous preterm delivery was correlated with the UEFW.

Results: Out of 965 subjects 62 were either excluded as per exclusion criteria or lost for follow-up. Out of 91 subjects with fetal weights $\leq$ 10th centile 17 (18.7%, OR 1.82, p-value 0.003) and out of 180 with that $\leq$ 20th centile 29 (16.1% OR 1.51, p-value 0.040) had preterm delivery. When the deviation was below 0.85 MoM, 15 out of 73 (20.5% OR 2.08, p-value 0.024) subjects had preterm delivery.

Conclusion: When UEFW in early third trimester is below 20th centile or below 0.80 MoM the risk for spontaneous preterm delivery increases, hence, it may be prudent to be vigilant when the fetal weight is between 10th and 20th centile to avoid preterm delivery.

Keywords: Fetal growth restriction, Preterm delivery, Ultrasound estimated fetal weight.

[1]Professor, [2]Resident

[1,2]Department of Obstetrics and Gynecology, Kasturba Medical College, Manipal, Karnataka, India

Corresponding Author: Muralidhar V Pai, Department of Obstetrics and Gynecology, Kasturba Medical College, Manipal Karnataka, India, Phone: 00918202922379, e-mail: drmvpai@yahoo.com

INTRODUCTION

Preterm delivery is a result of variety of mechanisms activating the common pathway of parturition. Intrauterine infection, uterine ischemia, immune reaction and endocrine disorders are pointed as potential causal factors, and the same may indirectly trigger pathological and adaptive mechanisms affecting fetal growth. The fetus is considered to be growth restricted when its weight is less than 10th centile of its peers in a given gestational age and pregnancies with growth restricted fetuses are known to be vulnerable for preterm labor (PTL). Filiberto M Severi and co-workers concluded that ultrasound estimated fetal weight (UEFW) slightly below the median also is associated with increased risk of spontaneous preterm birth.[1] This study was conducted to find out the association of UEFW between 10th and 50th centile, as well as weight below the median in early third trimester (28–34 weeks) and the risk of spontaneous preterm delivery.

MATERIALS AND METHODS

It was a prospective, case-control study conducted at the Department of Obstetrics and Gynecology, Kasturba Medical College, Manipal, Manipal University, India, between September 2012 and August 2014. The study was approved by the institutional ethics committee and informed consent was obtained from each participant.

Fetal weight of 965 women with singleton pregnancy was estimated using 5MHz transabdominal transducer of Toshiba Nimio ultrasound machine, between 28 and 34 weeks. Women with multiple gestation, medical disorders, fetal anomalies and induced labor were excluded. Maternal age, parity, medical and obstetric history were noted. General physical, systemic and obstetric examination were performed. Gestational age was defined according to the last menstrual period.

'Sonocare' software developed by Medialogic Solutions, Chennai, India, was used to calculate the fetal weight. The centile values for each gestation were calculated after ensuring that each period of gestation had a minimum of 100 subjects and they were as given in Table 1.

Table 1: Centile values for each gestation

POG in completed weeks	EFW at 10th centile	EFW at 20th centile	EFW at 30th centile	EFW at 40th centile	EFW at 50th centile
28 weeks	985.20	1011.0	1053.90	1076.00	1112.00
29 weeks	1100.00	1146.80	1190.60	1222.00	1255.00
30 weeks	1179.40	1256.80	1327.40	1387.0	1435.00
31 weeks	1320.00	1433.20	1473.80	1551.20	1571.00
32 weeks	1550.60	1601.00	1655.30	1689.80	1748.50
33 weeks	1695.00	1765.60	1864.80	1932.00	1989.00
34 weeks	1859.00	1965.0	2013.80	2099.40	2157.00

Values of UEFW were converted first into centile values and then into multiples of median (MoM) for each gestational age. The risk of spontaneous preterm delivery was correlated with the UEFW.

Quantitative variables were summarized as means ± standard deviation and differences between the two groups were assessed by unpaired student's t-test. For dichotomous variables, Pearson Chi-square test was used and statistical significance was assumed whenever $p < 0.05$. The odds ratio for preterm parturition syndrome were calculated for several cut-off points of UEFW expressed in both centiles and MoMs.

RESULTS

Out of 965 subjects recruited for the study, 62 were either excluded as per exclusion criteria or lost for follow-up hence only 903 were considered for final analysis (Flow Chart 1).

Out of 903 subjects, 91 (10.1%) had fetuses with UEFW ≤10 centile for their period of gestation; 89 (9.9%) had them between 11th and 20th centile, 88 (9.7%) had between 21st and 30th centile, 94 (10.4%) had between 31st and 40th centile, 87 (9.6%) had between 41st and 50th centile and 454 (50.3%) had fetuses weighing above 50th centile (Table 2). A total age, parity and the mean gestational age at which the UEFW was performed in subjects delivered at term and preterm were matched. The mean UEFW at the time of estimation of fetuses that delivered at preterm was 1455.57 ± 329.54 gm and that of fetuses delivered at term was 1642.80 ± 378.94 gm. This

Table 2: Distribution of subjects in different centile ranges n = 903

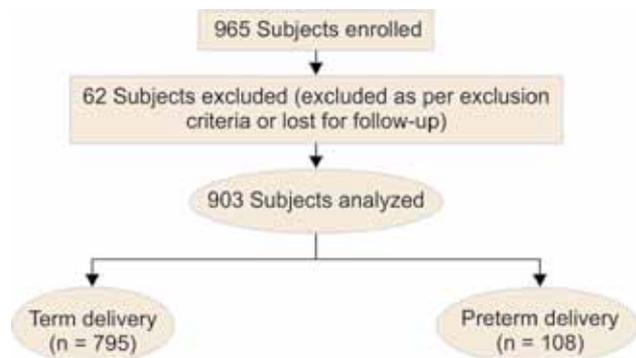| Centile range	Number of women (%)
≤10th	91 (10.1%)
11th–20th	84 (9.9%)
21st–30th	88 (9.7%)
31st–40th	94 (10.4%)
41st–50th	87 (9.6%)
>50th	454 (50.3%)

difference was statistically significant (p = 0.028). The mean gestational age of fetuses that had preterm delivery was 34.22 ± 1.98 weeks and their mean birth weight was 2187.50 ± 499.74 gm whereas those were 38.38 ± 1.09 weeks and 2187.50 ± 499.74 gm respectively. These differences were statistically highly significant (p = 0.000 and 0.000) (Table 3).

Table 4 shows the risk of preterm delivery when the UEFWs were equal to or less than 10th, 20th, 30th, 40th and 50th centiles. Out of 91 women whose fetal weights were ≤10th centile 17 (18.7%, OR 1.82) women had preterm delivery. Out of 180 that had fetuses weighing ≤20th centile 29 (16.1% OR 1.51) delivered preterm. These two findings were statistically significant (p-values: 0.033 and 0.040 respectively).

When the fetal weights were ≤30th centile 38 out of 268 (14.2% OR 1.33), when that were ≤40th centile 48 out of 362 (13.3% OR 1.24) and when that were ≤50th centile 59 out of 454 (13.1% OR 1.20) women had preterm delivery. These findings were statistically not significant (p-values: 0.112, 0.189 and 0.162 respectively).

Table 5 shows the risk of preterm delivery when the UEFWs were below 0.90, 0.85, 0.80, 0.75 MoM. Out of 169 women whose fetal weights had deviation below 0.90 MoM, 25 (14.8%, OR 1.36) women had preterm delivery. This finding was statistically not significant (p-value: 0.131).

When the deviation was below 0.85 MoM, 15 out of 73 (20.5% OR 2.08) women, when the deviation was below 0.80 MoM, 9 out of 31 (29% OR 3.19) women and when the deviation was below 0.75 MoM 6 out of 12 (50% OR 7.77) had preterm delivery. These findings had statistical significance (p-values: 0.024, 0.007 and 0.001 respectively).

Flow Chart 1: Consort statement

International Journal of Infertility and Fetal Medicine, September-December 2015;6(3):108-111

Table 3: Demographic and clinical parameters of subjects delivered at preterm and term (n = 903)

Characteristics	Preterm delivery (n = 108)	Term delivery (n = 795)	p-value
Maternal age (years)	27.67 ± 4.53	28.20 ± 4.07	0.143
Primigravida	70	503	0.515
Multigravida	38	292	
Mean gestational age at ultrasound estimation (in completed weeks)	30.33 ± 1.68	31.17 ± 1.89	0.056
Mean UEFW at estimation (in grams)	1455.57 ± 329.54	1642.80 ± 378.94	0.028
Mean gestational age at delivery	34.22 ± 1.98	38.38 ± 1.09	0.000
Mean weight at delivery	2187.50 ± 499.74	2994.04 ± 383.26	0.000

Statistical test-independent samples t-test; p-value significant if < 0.05

Table 4: Correlation between the risk of preterm delivery with UEFWs equal to or less than 10th, 20th, 30th, 40th and 50th centiles (n = 903)

Centile values	Preterm delivery (n = 108)	Term delivery (n = 795)	p-value	Odds ratio
≤10 (91)	17 (18.7%)	74 (81.3%)	0.033	1.82
>10 (812)	91 (11.2%)	721 (88.8%)		
≤20 (180)	29 (16.1%)	151 (83.9%)	0.040	1.51
>20 (723)	79 (10.9%)	622 (89.1%)		
≤30 (268)	38 (14.2%)	230 (85.8%)	0.112	1.33
>30 (635)	70 (11.0%)	565 (89.0%)		
≤40 (362)	48 (13.3%)	314 (86.7%)	0.189	1.24
>40 (541)	60 (11.1%)	481 (88.9%)		
≤50 (449)	59 (13.1%)	390 (86.9%)	0.162	1.20
>50 (454)	49 (10.8%)	405 (89.2%)		

*Statistical test: Pearson Chi-square test; p-value significant if < 0.05

Table 5: Correlation between the risk of preterm delivery with UEFW below 0.90, 0.85, 0.80, 0.75 MoM n = 903

Deviations from the median in MoM	Preterm delivery (n = 108)	Term delivery (n = 795)	Significance (p-value)	Odds ratio
≥0.90 MoM (734)	83 (11.3%)	651 (88.7%)	0.131	1.36
<0.90 MoM (169)	25 (14.8%)	144 (85.2%)		
≥0.85 MoM (830)	93 (11.2%)	737 (88.8%)	0.024	2.08
<0.85 MoM (73)	15 (20.5%)	58 (79.5%)		
≥0.80 MoM (872)	99 (11.4%)	773 (88.6%)	0.007	3.19
<0.80 MoM (31)	9 (29.0%)	22 (71.0%)		
≥0.75 MoM (891)	102 (11.4%)	789 (88.6%)	0.001	7.77
<0.75 MoM (12)	6 (50.0%)	6 (50.0%)		

*Statistical test: Pearson Chi-square test; p-value significant if < 0.05

DISCUSSION

Discovering the predictors of preterm delivery helps in timely intervention with tocolytics to delay the progress of labor, administration of corticosteroids to bring about lung maturity and *in utero* transfer to a higher center for neonatal intensive care unit (NICU) care. Being product of the similar pathophysiology, fetal growth restriction can serve as a forerunner of spontaneous preterm labor.

In our study, 449 subjects had fetuses weighing ≤50th centile and 454 had those weighing above 50th centile. The distribution of subjects in different centile ranges below the 50th centile was more or less uniform avoiding the bias between the groups (Table 2). The demographic characteristics like maternal age, and parity influence the occurrence of preterm delivery. In our study they were matched in both the groups so also the age at which the UEFW was performed.

The mean UEFW at the time of estimation, of fetuses that had preterm delivery was significantly lesser (1455.57 ± 329.54 gm) when compared those that delivered at term (1642.80 ± 378.94 gm) p = 0.028 (Table 3) suggesting that growth restriction is a good predictor of preterm delivery. It is a known fact that growth restriction below the 10th centile is associated with an increased risk for preterm labor. This study was conducted to find out whether there is any significant risk when the fetus is between 10th and 50th centile. Table 4 shows that the risk of preterm delivery is almost similar (16.1%) when the cut-off is increased to 20th centile as when the cut-off is 10th centile (18.7%). This finding was statistically significant also (p = 0.040, OR 1.51). However, the risk decreases as the fetal weight approaches 50th centile. Similarly, the fetuses with a UEFW below 0.85 MoM had two fold and those below 0.80 MoM had three fold increased risk to go into

spontaneous preterm delivery (p = 0.020, OR 2.08 and 0.007, OR 3.19 respectively) (Table 5). Both these findings reaffirm that not just the babies below 10th centile but those between 10th and 20th centile also herald the risk of preterm delivery. This proves the hypothesis that suboptimal fetal weight and preterm delivery are linked and belong to the same spectrum with similar adaptive responses of the fetus to a hostile *in utero* environment, arising from any pathological process, such as intrauterine infection, placental insufficiency or an altered immunological response to the ongoing pregnancy.

Findings of our study were comparable to those conducted by Bukowski R et al[2] and Lysikiewicz A et al.[3] Both the studies had concluded that the growth impairment was more common in fetuses that delivered at preterm than at term and significantly more fetuses did not reach 5th, 10th and 25th centile of their growth potential.

Another study involving 3653 uncomplicated pregnant women, showed that the odds ratio for preterm delivery increased even with slight deviation of UEFW below the median and with further deviation, the likelihood for preterm delivery increased drastically.[1]

A systematic review regarding the prediction of spontaneous preterm birth put forward the proposal that a more accurate prediction may be possible by combining several tests, including cervical length prediction and fetal fibronectin measurement in cervicovaginal fluid.[4] But such tests deal with only one aspect of preterm labor, i.e. cervical changes and this may be too late to take appropriate preventive steps. Other aspect, namely fetoplacental developmental pathology, which results in fetal growth restriction may predict preterm labor earlier. Ultrasound estimation of fetal weight may hold good promise in predicting impending preterm labor and delivery well in time to intervene and prevent fetal morbidity.

CONCLUSION

In uncomplicated low-risk asymptomatic pregnancies between 28 and 34 weeks, an UEFW below 20th centile or a deviation below 0.80 MoM increases the risk for spontaneous preterm delivery. Hence, it may be prudent to be vigilant and proactive when the fetal weight is between 10th and 50th centile especially when it is between 10th and 20th centile to avoid preterm delivery and subsequent fetal morbidity and mortality.

REFERENCES

1. Severi FM, Bocchi C, Imperatore A, Boni C, Ferrata C, Florio P, Reis FM, Petraglia F. Ultrasound estimated fetal weight slightly below the median is associated with increased risk of spontaneous preterm birth. Prenat Diagn 2012 Jun;32(6): 588-591.
2. Bukowski R, Gahn D, Denning J, Saade G. Impairment of growth in fetuses destined to deliver preterm. Am J Obstet Gynecol 2001 Aug;185(2):463-467.
3. Lysikiewicz A, BraceroLA, Tejani N. Sonographically estimated fetal weight percentile as a predictor of preterm delivery. J Matern Fetal Med 2001 Feb;10(1):44-47.
4. Honest H, Forbes CA, Duree KH, Norman G, Duffy SB, Tsourapas A, Roberts TE, Barton PM, Jonett SM, Hyde CJ, et al. Screening to prevent spontaneous preterm birth: systematic reviews of accuracy and effectiveness literature with economic modelling. Health Technol Assess 2009 Sep;13(43):1-627.